THE

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AND OF

THE INSTITUTIONS IN UNION.

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Announcements by the Council.

PRIZES FOR ART-WORKMEN.

The Council of the Society of Arts offer prizes to Art-Workmen as follows:—

1ST DIVISION.

WORKS TO BE EXECUTED FROM PRESCRIBED DESIGNS.

CLASS 1.—CARVING IN MARBLE, STONE, OR WOOD.

(*a.*) *The Human Figure.*—Two prizes of £15 and £7 10s. respectively. Subject:—The Boy and Dolphin cast from a chimney-piece, ascribed to *Donatello.*

(*b.*) *Ornament.*—Two prizes of £10 and £5 respectively. Subject:—A carved chair-back.

(*c.*) *Ornament.*—Two prizes of £10 and £5 respectively. Subject:—A *Gothic bracket.*

(*d.*)—Two prizes of £20 and £10 respectively. Subject:—A design by *Holbein*, as an *Inkstand* or *Watch-Holder.*

(*e.*)—Two prizes of £15 and £7 10s. respectively. Subject:—*Head of a Harp* of the period of Louis XVI.

(*f.*) *Ornament.*—Two prizes of £10 and £5 respectively. Subject:—An *Italian picture frame.*

CLASS 2.—REPOUSSÉ WORK IN ANY METAL.

(*a.*) *The Human Figure as a bas-relief.*—Two prizes of £10 and £5 respectively. Subject:—*Raphael's "Three Graces."*

(*b.*) *Ornament.*—Two prizes of £5 and £3 respectively. Subject:—A Flemish salver.

CLASS 3.—HAMMERED WORK, IN IRON, BRASS, OR COPPER.

Ornament.—Two prizes of £7 10s. and £5 respectively. Subject:—A portion of the Pediment of a Gate (German work, date about 1700).

CLASS 4.—CARVING IN IVORY.

(*a.*) *Human Figure in the round.*—Two prizes of £15 and £10 respectively. Subject:—An *Ivory*, by *Fiamingo.*

(*b.*) *Ornament.*—Two prizes of £7 10s. and £5 respectively. Subject:—A pair of *Tablets.*

CLASS 5.—CHASING IN BRONZE.

(*a.*) *The Human Figure.*—Two prizes of £10 and £5 respectively. Subject:—A reduced copy of "*Clytie.*"

(*b.*) *Ornament.*—Two prizes of £10 and £7 10s. respectively. Subject:—A cabinet, by Goutier.

CLASS 6.—ETCHING AND ENGRAVING ON METAL—NIELLO WORK.

Ornament.—Two prizes of £10 and £5 respectively. Subject:—Arabesques, by Lucas Van Leyden, 1528.

CLASS 7.—ENAMEL PAINTING ON COPPER OR GOLD.

(*a.*) *The Human Figure.*—Two prizes of £10 and £5 respectively. Subject:—*Raphael's design of the "Three Graces."*

(*b.*) *Ornament.*—Two prizes of £5 and £3 respectively. Subject:—A German arabesque (16th century).

CLASS 8.—PAINTING ON PORCELAIN.

(*a*) *The Human Figure.*—Two prizes of £10 and £5 respectively. Subject:—*Raphael's "Two Children,"* in the cartoon of "*Lystra.*"

(*b.*) *Ornament.*—Two prizes of £5 and £3 respectively. Subject:—Arabesques, by Lucas Van Leyden, 1528.

CLASS 9.—DECORATIVE PAINTING.

(*a.*) *Ornament.*—Two prizes of £5 and £3 respectively. Subject:—An *ornament*, from *Castel R. Pandino*, near Lodi.

(*b.*) *Ornament.*—Two prizes of £5 and £3 respectively. Subject:—A *picture frame*, in the South Kensington Museum.

CLASS 10.—INLAYS IN WOOD (MARQUETRY, OR BUHL), IVORY OR METAL.

Ornament.—Two prizes of £5 and £3 respectively. Subject:—A specimen.

CLASS 11.—CAMEO CUTTING.

(*a.*) *Human Head.*—Two prizes of £10 and £5 respectively. Subject:—*Wyon's* heads of the Queen and the Prince Consort, on the Juror's medal of 1851.

(*b*) *Animal.*—Two prizes of £10 and £5 respectively. Subject:—*Wyon's "St. George and the Dragon,"* on the Prince Consort's medal.

CLASS 12.—ENGRAVING ON GLASS.

Ornament.—Two prizes of £5 and £3 respectively. Subject:—Arabesques by Lucas Van Leyden, 1528.

CLASS 13.—WALL MOSAICS.

Human Head.—Two prizes of £15 and £10 respectively. Subject:—A work by *Bertini*, of Milan.

CLASS 14.—GEM ENGRAVING.

(*a.*) *Human head.*—Two prizes of £10 and £5 respectively. Subject:—An original Gem.

(*b.*) *Full-length figure.*—Two prizes of £10 and £5 respectively. Subject:—An original Gem.

CLASS 15.—DIE SINKING.

Human head.—Two prizes of £10 and £5 respectively. Subject:—The head of the Prince Consort, by *Wyon*, on the Society's medal.

CLASS 16.—GLASS BLOWING.

Ornament.—Two prizes of £7 10s. and £5 respectively. Subject:—An original in the South Kensington Museum.

CLASS 17.—BOOKBINDING AND LEATHER WORK.

(*a.*) *Bookbinding.*—Two prizes of £7 10s. and £5 respectively. Subject:—An Italian specimen in the South Kensington Museum.

(*b.*) *Leatherwork.*—Two prizes of £7 10s. and £5 respectively. Subject:—A specimen of boiled and cut leatherwork for the outside covering of a jewel casket, the original being in the South Kensington Museum.

CLASS 18.—EMBROIDERY.

Ornament.—Two prizes of £5 and £3 respectively. Subject:—A German example in the Green Vaults at Dresden, or an Italian Silk in the South Kensington Museum.

2ND DIVISION.

WORKS TO BE EXECUTED WITHOUT PRESCRIBED DESIGNS.

WOOD CARVING.

(*a.*) *Human figure in alto or bas relief. Animals or natural foliage may be used as accessories.* 1st prize of £25 and the Society's Silver Medal. 2nd prize of £15. 3rd prize of £10.

(*b.*) *Animal or still-life. Fruit, flowers, or natural foliage may be used as accessories.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

(*c.*) *Natural foliage, fruit, or flowers, or conventional ornament in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

All articles for competition must be sent in to the Society's house on or before Saturday, the 26th of November, 1864, and must be delivered free of all charges. Each work sent in competition for a Prize must be marked with the Art-workman's name, or, if preferred, with a cypher, accompanied by a sealed envelope giving the name and address of the Art-workman.

Photographs, engravings, &c., of the above subjects may be purchased at the Society's house at cost prices. Full particulars, with conditions, may be obtained from the Secretary of the Society of Arts, to whom all persons desiring to become competitors should apply.

Copies of the following engravings are forwarded to the members with this week's *Journal*, and should be bound with the volume:—

CLASS I. (*d.*).—Design by Holbein, as an inkstand or watch-holder, to be carved in wood.

CLASS IX. (*a*).—Decorative Painting. Ornament from Castel R. Pandino.

CLASS X.—Inlays in wood, ivory, or metal.

INSTITUTIONS.

The following has been received into Union:—

Kent Association of Institutes.

EXAMINATIONS.

The Council, having been invited by the Science and Art Department to nominate a limited number of candidates to compete for appointments, as book-keepers, in the Stores Branch of that department, are happy to announce that Henry Kearns, aged 17, Aldershot Institution, and William Heap Bailey, aged 19, Derby Mechanics' Institution, have succeeded in the competition. The conditions of this competition were such that, in making their selection, the Council were restricted by the age of the candidates as well as by the special qualifications required.

Proceedings of the Society.

CANTOR LECTURES.

"ON CHEMISTRY APPLIED TO THE ARTS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE III.

DELIVERED ON THURSDAY EVENING, APRIL 14TH, 1864.

LEATHER.—The art of the currier. Morocco, Russia, and patent leathers. The art of tawing skins. Chamois and glove skins. **Parchment.** *Hair*, its composition and dyeing. *Wool*, its washing, scouring, bleaching, and dyeing. *Silk*, its adulterations and conditioning.

I shall have to crave the indulgence and patience of my audience during this lecture, as it will chiefly consist of descriptions of processes for the most part well known to manufacturers and others engaged in the leather trade. Thus, the art of currying, which is applied principally to such leathers as are intended for the upper parts of shoes, for harness, &c., is carried on at the present day nearly as it was fifty years ago, and still is but little known to the public.

Currying.—The objects in view in currying leather are several: to give it elasticity—to render it nearly impermeable—to impart to it a black or other colour, and, lastly, to reduce it to uniform thickness. These qualities are imparted by the following processes: After the leather obtained from hides or the thicker qualities of skins has been damped, it is placed on a stone surface and energetically rubbed, first with a stone, then with a special kind of knife called a slicker, and lastly with a hard brush. The leather is then ready to be stuffed or dubbed, which consists in covering it on the fleshy side with tallow, and hanging it in a moderately warm room; and as the water contained in the leather evaporates, the fatty matter penetrates into the substance of the leather and replaces it. The dubbing process is then repeated on the other side of the leather, which is now ready to be softened and rendered flexible, and this is effected by rubbing it with a tool called a pummel. The leather then undergoes the last mechanical operation, which reduces it to uniformity of thickness by shaving off the inequalities of its surface by means of a peculiarly shaped knife called a slicker. The greatest part of the curried leather is blackened on the grain side by rubbing it with grease and lamp black, and lastly brushing it over with a mixture of grease and glue. I believe that some kinds of curried leather are dyed by a purely chemical process, that of rubbing the tanned skin, first with iron liquor, and then with a solution of gall nuts or other tanning substance. The most tedious of the foregoing processes is that of dubbing, which has been greatly improved of late years by the Americans. The scoured skins are placed in a large revolving drum, of ten or twelve feet diameter, and lined inside with wooden pegs. A certain quantity of tallow is then introduced and the whole set in motion, and whilst the hides are thus tossed about, a current of warm air is passed through the drums, which carries off the moisture and allows the grease to penetrate the hide. By this means thick hide leather can be stuffed in four or five days.

Split Leather.—A large branch of trade has sprung up within a few years owing to the invention of machinery for splitting hides, skins, and kips, by which the quantity of leather has been considerably increased, though I am afraid this has been done at the expense of its quality.

Fancy Leathers.—Allow me now to give you a slight insight into the methods of preparing various fancy leathers, such as Morocco, Russia enamelled, tawed, or kid leather, used for soldier's belts, gloves, &c., and, lastly, oiled leathers, used for washleather, gloves, &c. Until the middle of the eighteenth century Morocco leather was wholly imported from that country, for it was in 1735 that the first Morocco works were established in Paris, and similar manufactories were soon set up in various parts of the Continent and in this country. The process by which Morocco leather is prepared is as follows:—The goat and sheep skins, which are especially used for this branch of manufacture, are softened, fleshed, unhaired, and raised or swelled by methods similar to those already described, but one essential element of success in this kind of leather lies in the perfect removal of all lime from the skins, which is effected by plunging the well-washed skins in a bath of bran or rye flour, which has been allowed to enter into a state of fermentation. The result is, that the lactic and acetic acids generated by fermentation of the amylaceous substances combine with the lime and remove it from the skins. The other essential point is the mode of tanning the skins. Each skin is sewn so as to form a bag, and filled, through a small opening, with a strong decoction of sumac, and after the aperture has been closed the skins are thrown into a large vat containing also a decoction of the same material. After several hours they are taken out, emptied, and the operation is repeated. To render these skins ready for

commerce it is necessary to wash, clean, and dye them. The last operation was formerly tedious, and required great skill, but since the introduction of tar colours, the affinity of which for animal matters is so great, it has become comparatively easy. The skins after they have been dyed, are oiled, slightly curried, and the peculiar grain, characteristic of Morocco leather, is imparted to them by means of grooved balls or rollers. There are two inferior kinds of Morocco leather manufactured, viz., those called *roan*, prepared in a similar way to Morocco, but not grained, and *skivers*, also prepared in the same manner, but from split sheep skins. I owe to the kindness of Mr. Warren De la Rue, the beautiful specimens of leather before me, which will enable you to appreciate the various qualities of these interesting productions.

Russia Leather.—The great esteem in which this leather is held is owing to its extreme softness and strength, its impermeability, and resistance to mildew, which latter property is imparted to it by the use of a peculiar oil in its currying, that is birch-tree oil, the odour of which is well-known as a distinguishing feature of Russia leather. As to its preparation, I will merely state that it is very similar to that of Morocco, with these differences, that hot solutions of willow bark are used instead of sumac; that it is generally dyed with sandal wood and a decoction of alum; and, lastly, as already stated, the birch-tree oil is used in currying it.

Enamel Leather.—This class of leather is usually prepared with calf and sheep skins tanned in the ordinary manner. They are dyed black by rubbing them over with a decoction of logwood, and then with iron liquor or acetate of iron. The leather is softened with a little oil, and is ready to receive a varnish, which is applied by means of a brush. The varnish is composed of bitumen of Judea, copal varnish, oil varnish, turpentine, and boiled oil.

Tawed or Kid Leathers.—The manufacture of this class of leathers differs entirely from that of those already described, as their preservative qualities are imparted by quite different substances from those used with other leathers, the preservative action of the tannin being substituted by that of a mixture of alum and common salt. Let us examine together a few points connected with the production of this class of leather. One of the most interesting characteristics is the method of unhairing sheep, lamb, and kid skins, after they have been well washed and fleshed on the beam. The old process of unhairing by smearing on the fleshy side with a milk of lime, was improved by mixing with the lime a certain amount of orpiment, or sulphuret of arsenic, but Mr. Robert Warrington having ascertained that the rapid removal of hair in this case was not due to the arsenic, but to the formation of sulphuret of calcium, proposed, with great foresight, the following mixture as a substitute for the dangerous and poisonous substance called orpiment, viz.: Three parts of polysulphuret of sodium, 10 parts of slacked lime, and 10 parts of starch. The polysulphuret of sodium may be advantageously replaced by the polysulphuret of calcium. The skins, unhaired by any of these processes, are now ready to be placed in a bran or rye bath, as with Morocco leather, or in a weak solution of vitriol, to remove, as already stated, the lime. After the lime has been thoroughly removed from the skins, they are dipped in what is called the white bath, which is composed for 100 skins of 13 to 20 lbs. of alum and 4 to 5 lbs. of chloride of sodium or common salt, and the skins are either worked slowly in this bath or introduced into a revolving cylinder to facilitate the penetration of the preservative agent, which, according to Berzelius, is chloride of aluminium resulting from the action of the chloride of sodium on the alum. When the manufacturer judges that the skins have been sufficiently impregnated with the above mixture, he introduces them into a bath composed of alum and salt in the same proportions, but to which are added 20lbs. of rye flour and fifty eggs for 100 skins. After remaining a few hours they are removed, and allowed to dry for about fifteen days, and are then softened by working them with a peculiar iron tool, the white surface which characterises that class of leather being communicated to them by stretching them on a frame and rubbing them with pumice stone. A large quantity of tawed leathers are also preserved, retaining their hair, which is done by simply suppressing the unhairing and rubbing processes.

Chamois, Wash, or Oiled Leather.—These classes of leather are named from the fact that formerly they were exclusively produced from the skin of the chamois, but at the present day sheep, calf, and deer skins, and even split thin hides, are manufactured into this kind of leather. I should also state that the employment of this kind of leather has greatly decreased of late years, owing to the general substitution of woollen fabrics in articles of clothing. You will see by the following description that the preparation of this class of leather differs entirely from those previously detailed; the conversion of skins into leather, or from a substance subject to putrefaction to one free from that liability, being no longer effected by tannin, as in the case of hides, and Morocco and Russia leathers, or by the use of mineral salts, as in the case of tawed leathers, but by that of fatty matters, especially animal oils, such as sperm. The skins are prepared in the same manner as for tawed leathers, and then submitted to what is called the prizing operation, which consists in rubbing the hair side of the skin with pumice stone and a blunt tool or knife, until the whole of the rough appearance is removed, and the skin has acquired a uniform thickness. They are then worked on the peg until the great excess of moisture has been wrung out, and plunged into the trough of a fulling mill, to the action of the wooden hammers of which they are subjected until nearly dry. They are then placed on a table and oiled, and several of them, after being rolled together, are replaced in the trough of the fulling mill. When the oil has been thus worked into the substance of the skins, they are removed, exposed to the atmosphere, again oiled, and once more subjected to the fulling mill; after which they are placed in a moderately heated room for a day or two, the object of which is twofold, viz., to facilitate the evaporation of the water and the penetration of the oil, and to create a slight fermentation, by which the composition of certain of the organic substances have undergone such modification as to enable them to combine in a permanent manner with the fatty matters. These processes are repeated until the manufacturer deems the leather sufficiently prepared to be fit to undergo the following operations, viz., to be immersed for several hours in a caustic lye bath, to remove the excess of oily matter, washed, and pegged. It is only necessary to stretch the leather on a table, then on a horse, and lastly between rollers, after which it is ready for the market. The ordinary buff colour of these leathers is communicated by dipping them, previously to the finishing processes, into a weak solution of sumac. Before speaking of the further processes necessary to fit these leathers for the glove manufacturer, allow me to have the pleasure of describing that of Mr. C. A. Preller, whose mode of preparing leather is very interesting, owing to the rapidity with which he converts hides into leather, and also to the remarkable toughness which his leather possesses. To attain these desirable ends Mr. Preller proceeds as follows:—The hides are washed, slightly limed, unhaired, fleshed, and partially dried; they are then smeared with a mixture made of fatty matters and rye flour, which having been prepared a few days previously has entered into fermentation, a process which has so modified the fatty matters as to render them more susceptible of immediate absorption by the hide. I think that this feature of Mr. Preller's plan deserves the serious notice of all engaged in the manufacture of oiled leathers, as it appears to prove that fatty acids (or modified fatty matters) are better suited for combination with skins than neutral fats. The hides, with additional fatty matters,

are then introduced into the large American drums, previously noticed in speaking of currying, and after four days they are removed, washed in an alkaline fluid, worked with a pummel and slicker, and after being dried they are ready for market.

Gloves.—The manufacture of this article is now a most important branch of trade, and is the means of giving employment to large numbers of people in several towns in this country as well as on the Continent. To render the above-mentioned oiled leather sufficiently soft and pliable for gloves it is necessary to submit it to the following further operations:—The Chamois, kid, or other skins are rubbed over with a solution composed of 1lb of soap, dissolved in half a gallon of water, to which is added 1½lb of rape seed oil, and 20 yolks of eggs, or, what has been recently found to answer better than eggs, a quantity of the brains of animals reduced to pulp. The use of the two latter substances is extremely interesting in a scientific point of view, for they both contain a peculiar nitrogenated matter called vitalline, and special fatty matters called oleophosphoric and phosphoglyceric acids, which doubtless, by their peculiar composition, communicate to the skins those properties which characterise this class of leather. The skins are then washed and dyed in various colours, after which they are softened, and rubbed with an instrument adapted to slightly raise the surface, and give it that well-known velvetty appearance belonging to glove skins. I shall not take up your time by entering into the details of dyeing these leathers, but describe the following process for bleaching them:—

Bleaching of Skins.—The only process known until recently for imperfectly bleaching chamois and glove skins, was that of submitting them to the influence of the fumes of sulphur in combustion, or sulphurous acid, but latterly two modes of attaining that object have been proposed. The first consists in dipping skins, for two days, in a weak solution of neutral hypochlorite of soda, washing, drying, and rubbing them with soap and oil. The second mode is to dip glove skins into a solution of permanganate of potash, when they soon assume a brownish colour, due to the liberation of the oxygen of the permanganate of potash, and the fixation of the hydrate of sesquioxide of manganese by the skin. The skins so acted on are washed and then dipped in a solution of sulphurous acid, which becomes converted into sulphuric acid by the action of the oxygen of the sesquioxide of manganese, and the protoxide thus produced unites with the sulphuric acid which is soluble in water. The skins thus bleached when dressed are ready for market.

Gilding of Leather.—The usual mode of ornamenting leather with gold is to apply, in such parts as are desired, a thick solution of albumen, covering those parts with gold leaf, and applying a hot iron, when the albumen is coagulated and fixes the gold. This plan is objectionable when the goods are intended for shipment, and the following method, lately proposed, is far preferable: On the parts required to be gilt, a mixture, composed of five parts of copal and one of mastic, are spread; a gentle heat is applied, and when the resins are melted the gold leaf is spread upon them.

Parchment.—There are two distinct qualities of this valuable material, which has been used from time immemorial as a means of preserving records. The best quality is prepared from young lamb, kid, and goat skins, and the second quality from calf, wolf, ass, and sheep skins. To make parchment the following is the process:—The skins are stretched on strong rectangular frames, limed, unhaired, fleshed very carefully, and rubbed with pumice stone, until they have acquired the proper thickness. They are then dried very carefully in the shade.

Dialysis.—Mr. Thomas Graham, Master of the Mint, has lately drawn the attention of the scientific world to a most remarkable property possessed by organic membranes, of separating, when in solution, crystallisable bodies from those which are not so. The former he names crystalloids, and the latter colloids. For instance, if a solution of sugar (crystalloid) is mixed with one of gum (colloid) and placed in the vessel, the bottom of which consists of a septum of animal or vegetable parchment, the crystalloid sugar will pass through the membrane into the surrounding water, whilst the colloid gum will remain in the vessel. Again, if solutions of iodide of potassium and albumen be mixed together, the iodide of potassium will diffuse itself through the membrane, which the albumen will not do. Also if to an alkaline solution of silicate of soda, weak hydrochloric acid be cautiously added, chloride of sodium will be produced and silica will remain in solution, and if such a solution be placed in the dialyser, the chloride of sodium (the crystalloid) will diffuse itself through the membrane, while the silica (the colloid) will remain behind. It is impossible to calculate the immense service which the discovery of these facts by Mr. Graham will render to physiology, toxicology, and to manufactures, as in fact every day new applications of it are being made in these various departments of human research. Thus, to give an example which has special reference to these lectures, I have lately seen it proposed by Mr. A. Whitlaw to place salted meat in large dialysers, when it is stated that the salt only will be removed, leaving all the nutritive properties of the meat undiminished. Mr. Whitlaw also proposes to dialyse the brine in which meat has been salted, and thus to remove the salt, leaving the juice of the meat available for use, while the salt is again in condition to be employed as before.

It will now be my agreeable duty to examine with you a few facts relating to hair and wool. It is interesting to observe that hair, wool, feathers, nails, and claws, may be all considered as prolongations of the epidermis, and present nearly the same chemical composition, as will be seen by the following table:—

	Epidermis of Man.	Hide.	Man's nails.	Hair.	Quill.	Horse's hoof.	Scale of reptile.
Carbon	50·34	50·89	51·09	50·14	52·43	50·40	53·60
Hydrogen	6·81	6·78	6·12	6·67	7·22	7·00	7·20
Nitrogen	17·22	17·25	16·91	17·94	17·93	16·70	16·30
Oxygen & Sulphur.	25·63	25·08	25·88	25·25	22·42	25·90	22·90
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

These substances have also this peculiarity, that, notwithstanding their great richness in organic matters they are extremely slow to decompose.

Hair.—The only real point of interest connected with hair appears to me to be the question as to what its various colours are to be ascribed, and I regret that here I can only give conjectures and not positive facts. Vauquelin and Fourcroy, who analysed hair most carefully half a century ago, stated that hairs were hollow cylindrical tubes filled with oils of various colours; but Gmelin and others state that the coloration of hairs is due to the different proportions of sulphur that they contain.

QUANTITY OF SULPHUR IN HAIR.

Brown	4·98
Black	4·85
Red	5·02
Grey	4·03

Recently Mr. Barreswil has published a paper, in which he states that the coloration of hairs is probably due to the proportion of iron in their composition, and he argues that as iron is the essential element of the colouring matter of blood, it is highly probable that it fulfils the same office with respect to hair. I may state, *en passant*, that great improvements have lately been made in dyeing human hair. Formerly the patient had to undergo most unpleasant treatment, his head being covered with a paste consisting of three parts of lime and one of litharge. An oil cap was then applied and the patient left for twelve

hours, when the disagreeable operation of removing the mass and clearing the hair was proceeded with. The black dye communicated to the hair in this process was due to the sulphur of the hair combining with the lead of litharge, and forming black sulphuret of lead. The present process consists in cleaning the hair thoroughly with a strong alkaline soap, or a little weak alkali, then carefully applying a solution of nitrate of silver, and lastly a solution of monosulphuret of sodium.

Wool differs from hair chiefly by its property of felting, which it owes to its numerous cross lines or serratures, as they are termed; the finer the wool the greater the number of its serratures. Thus, whilst Mr. Goss has found in the finest Saxony wool, 2,720 of these serratures in a single inch in length, he only found 2,080 in an inch of South Down wool, and 1,850 in Leicester. The wool of sheep can be classed under two heads, that is, into long wool and short wool. Certain classes of sheep will maintain the type or quality of their wool under every circumstance. Such are the original types of South Down, Norfolk, and Dorset, all of which are short wool, and all these sheep feed upon fine and short grass. It has been observed that if they are fed upon coarse grass, their wool will also become coarse. This is also true with Welsh, Scotch, and even Spanish merinos. A further proof that this view appears correct is, that the long-wool sheep, such as those of Leicester, Lincoln, and Kent, feed in valleys where grass is long and coarse. In all cases the size of the animal appears also to correspond with their class of food. Another curious fact is the facility with which one type of sheep will merge into another if they change food and climate. Thus many attempts have been made to introduce into France our Leicester breed, the wool of which is so remarkable for its fineness, length, and silvery appearance. Still, after four or five years' residence there, the wool has lost its most valuable qualities. In fact the sheep are no more the Leicester breed. The coarse wool of sheep, however, such as those of Devonshire, does not appear to be so rapidly influenced by any change of climate which the animal may undergo. The aptitude which various kinds of wool have for dyes is also interesting. Thus the wool of one kind of sheep will not dye with the same facility as that of another; and wool dyes much more uniformly, if the animal has been washed before shearing, than when the washing is performed upon the wool afterwards. Lastly, the wool removed by the liming process before described, will be far inferior in dyeing properties to wool taken from the same kind of animal during life. It may be interesting to some present to know the best method of removing these irregularities. I was engaged during my assistantship at the Gobelins in investigating this matter, and I found that the best plan was to steep the wool for 24 hours in lime water, and then to pass it through weak hydrochloric acid. Wool, as it leaves the animal, is not fit for either dyeing or spinning. Thus when wool is washed with water it yields a large quantity and variety of substances, which in France bear the name of *suint*. The most interesting fact connected with this is, that the 15 per cent. yielded by wool does not contain, as shown by M. Chevreul, any salts of soda, but a large quantity of salts of potash, the greatest part of which is combined with an acid called sudoric; and what increases the interest of this fact is that Messrs. Maumené and Rogelet displayed at the last exhibition salts of potash which they had obtained commercially from this new source. In fact they have established in several of the large manufacturing centres of France, where considerable quantities of wool are used, factories for the extraction of salts of potash from the *suint*, and they supplied the jury with the following particulars:—That a fleece of wool weighing 8 lbs., yielded on the average about 1¼ lb. of dry suint, or sudorate of potash, and this would further yield about seven ounces of pure potash. If it is now considered that there is annually twenty million pounds of wool washed in Rheims, thirty millions at Elbeuf, and four millions at Fourmies, it would appear from this quantity that if it were all subjected to Messrs. Maumené and Rogelet's treatment, about 2¼ million pounds of pure potash might be recoverable. (For further details on this point see Dr. Hofmann's Report on Chemical Products and Processes in the last Exhibition.) Wool which has been simply washed, as above described, is not sufficiently free from extraneous matters to be fit for application in manufactures. It is necessary that it should be scoured, for which purpose, on the continent, it is allowed to remain for some time in putrid urine, or weak ammoniacal liquor, but in this country it is placed in strong alkaline of soap or soft soap, passed through rollers to press out the excess of soap, together with the impurities which it removes, well washed, and dried. In these operations wool loses in weight above 50 per cent. when of good quality, and above 30 per cent. when inferior. But even then the wool still retains a certain amount of fatty matters, which it yields to hot alcohol.

The following table, published by M. Chevreul, will give you an idea of the composition of wool (dried at 212°):—

Earthy matters	27·40
Organic and inorganic salts, soluble in water (*suint*)	32·74
Fatty matters	8·37
Wool	31·49
	100·000

Elementary composition, C. 50·66, H. 7·03, N. 17·74, O. 22·32, S. 2·25.

Before proceeding further, I should like to call your attention to the curious fact that the fatty matters of wool are completely different from the fatty matters of the animal itself; thus, whilst the ordinary suet will be saponified by an alkali, the fat of the wool will not undergo that change, the stearerine and elearine being only converted into an emulsion. From experiments I have made I am able to state, that the common opinion that the differences in quality observed in various wools are owing to their fatty matters is erroneous, as the pure wool obtained as above yielded to the dyer colours as brilliant as those presented by wools in which a part of the fatty matter still remained. Another important fact connected with the composition of wool is the quantity of sulphur it contains, which does not appear to be part of the fibre, as the matter containing it can be removed by a weak alkali without destroying the fibrous appearance of the wool, although its tenacity is greatly impaired, and its power of taking dye considerably diminished. Another remarkable fact is that when wool is bleached by sulphurous acid (the only agent known which will effect that purpose), it becomes incapable of taking many colours, especially the new and brilliant coal tar dyes. The long-disputed question amongst chemists—How sulphurous acid operates so as to bleach wool?—has lately been solved by Messrs. Leuchs and Weber, who have proved that sulphurous acid unites with the colouring matter of the wool, forming a colourless compound, in proof of which it appears that if the wool is placed in boiling water this colourless compound is dissolved, and the wool regains its susceptibility to dyes, though it is slightly discoloured. A slight amount of alkali added to the boiling water greatly facilitates the removal of this artificial sulphuretted compound. In a paper lately published by Mr. Grothe he states that 100 parts of wool fix on an average 0·67 of sulphur, or 1·31 of sulphurous acid to bleach it, and practically 100 parts of wool require about five parts sulphur to be burnt to produce the result. I should also state that wool must always be wet before being submitted to the fumes of sulphur, and it is always advantageous to pass it previously though a soap lye or weak alkali. Wool so bleached should always be well washed in cold water, to remove the excess of sulphurous acid, which otherwise, if the wool

were subsequently exposed to moisture, might be converted into sulphuric acid and destroy the fibre of the wool. It may be interesting to ladies to know the process used by a French scourer, named Jolly, to restore Cashmere shawls discoloured by time. It consists in dipping them into a solution of sulphurous acid, which bleaches the wool but does not affect the fast colours with which the fibres composing the patterns of the shawls are dyed. The shawls then only require to be washed and pressed to be restored to their original beauty. There is no doubt in my mind that a solution of sulphurous acid might be substituted for the gas in bleaching wool with advantage and economy, owing to the sulphurous acid being in a more condensed form, and in better condition for effecting the bleaching process. A few years ago I took advantage of the fact that wool contains sulphur to produce upon it an artificial lustre. The woollen goods were passed through a weak boiling solution of acetate of lead, washed carefully in pure water, and submitted to the action of high pressure steam, when the lead combined with the sulphur of the wool, producing galena, which gave the wool a lustre. The action was regulated by generating, under the influence of steam, nascent sulphuretted hydrogen from a polysulphuret of sodium, which facilitated the object in view. Wool is generally dyed either in the fleece, after undergoing the processes of washing and scouring, or it is first spun into yarn or worsted. To describe all the various methods of dyeing wool would far exceed the limits of this lecture. The operations of spinning wool into yarn or worsted are purely mechanical, and it is not therefore within my province to describe them. The same remark applies also to the manufacture of felt and shoddy, now so extensively carried on in Yorkshire, and I shall therefore merely refer to one or two points having reference to chemistry, such for instance as the working up of the wool or the cotton in worn-out fabrics. To recover the wool from such fabrics the process is most simple, consisting simply in immersing them in diluted muriatic acid, and drying them at a temperature of about 220°, by which means the cotton is completely destroyed, the wool remaining unaffected. The material is then submitted to the action of a "devil," which separates and blows away the cotton, leaving the wool ready for being worked up. To remove the vegetable fibre with the view of applying it to the purposes for which it is adapted, as the paper manufacture for instance, the following process has been devised by Mr. F. O. Ward and Captain Wynants. The mixed fabric is submitted to high pressure steam (60 to 80 lbs. to the square inch), and under the influence of this high and moist temperature the vegetable fibre remains unchanged, whilst the animal one is so much disorganised, that when the rags are removed from the receptacle and dried, and submitted to the action of a beating machine, the cotton fibre remains intact, whilst the animal matter falls to the bottom of the machine in the form of a dark-coloured powder mixed with small lumps of the same substance; this residue has been advantageously applied as a manure, by these gentlemen, under the name of "ulmate of ammonia." I am happy to state that chemical science has discovered several means of distinguishing cotton from wool when employed in the same fabric, and even of determining their respective weights in the same; but the aid of the magnifying powers of the microscope is often required in investigating the mixtures of wool with flax, cotton, jute, &c., which are now so extensively and so ingeniously spun together. The description of these processes, however, would involve so much technicality, and require so much time, that I must not trouble you with their details. The same remarks apply to the means used for distinguishing the materials used in mixed fabrics of silk and cotton, or silk, wool, and cotton.

Silk.—This material has always been highly-esteemed, owing to its remarkable durability, and to the beauty of the fabrics produced from it. Thus the Chinese have used silk from time immemorial, and the Romans held it in such high estimation that, in the time of the Cæsars, silk was worth its weight in gold. The most interesting fact for us is the date of the introduction of the silkworm into Europe; it is related that in A.D. 555 two monks, returning from the East, concealed some silkworms' eggs in their staves, and having succeeded in rearing the worms, their culture soon spread through Greece and Turkey, and gradually found its way into Italy towards the twelfth century. The silk in use at the present day is chiefly derived from the *Bombyx mori*, but the extensive disease which has during the last 8 or 10 years destroyed very large numbers of the worms, has given rise to great efforts to introduce some new species, two of which, the *Bombyx mylitta*, feeding on the *Palma christi* or castor-oil tree, and the *Bombyx ailanthi*, feeding on the plant from which it is named, have been to some extent successful. The material forming the silk is secreted in two glands placed on the side of the animal's body, whence it passes into an organ called the spinaret, on each side of which are two other glands, which secrete a gummy substance, and this uniting with the former forms the silk fibre. Permit me to add here a fact which I think will interest you, viz., the extraordinary weight of silk which a small weight of eggs will yield. Thus, four ounces of eggs will yield 87,900 to 117,000 cocoons, and as on an average a pound of silk requires 270 cocoons, the four ounces of eggs will give 422 lbs. of silk, or 100lbs. of cocoons yield generally 8 lbs. or about 14 per cent. of silk. The production of silk fibre from cocoons is extremely simple. It is effected by placing the cocoons in boiling water, which softens or dissolves the gummy matter which binds the fibres together, and the end of the fibre being detached and placed on a reel, is easily wound. This is the state in which it is usually imported into this country under the name of raw silk. When two or more of these fibres are slightly twisted together they form what is called tram or weft, and when two of the threads are twisted in opposite directions and laid together they form organzine or warp. To render this substance suspectible of dyeing, it is necessary to remove the gum by an operation called boiling off, which consists simply in boiling the silk for some time in a soap lye, and washing and wringing it well afterwards, in which operation it loses about 21 per cent. The following table will show the chemical composition of silk:—

Gelatine	19.08	Commercial yield 79 per cent of silk.
Albumen	25·47	
Wax and fatty substances	1·45	
Silk fibre.....	54·00	
	100·00	

FIBROINE.

Carbon, 48·53; hydrogen, 6·50; nitrogen, 17·35; oxygen and sulphur, 27·62.

Conditioning Silk.—This expression implies the ascertaining of the real commercial value of silk, or, in other words, its condition, and the necessity of this has been so fully admitted that a conditioning house has existed for 40 or 50 years in Lyons, and its advantages have been so fully appreciated that similar establishments have arisen and are well supported in every town on the Continent, where dealings in silk to any amount take place. I may mention, as an instance of the universal adoption of the practice, that even in Crefeld the finest building in the town is the conditioning house. The result is that on the Continent the intervention of the conditioning house between buyer and seller has become quite a matter of course, with the happy result of abolishing a class of dishonourable dealing, which is eating like a canker into the silk trade of Great Britain. I cannot understand why the attempts made to introduce this admirable system into our country have hitherto met with so little

success, and can only infer that there is an unsoundness in the trade, which places many of the silk manufacturers to a great extent under the control of wealthy merchants, who, it appears, are the chief opponents of conditioning. Otherwise one would suppose that its advantages to all engaged in working up this valuable product are too obvious to require demonstration, for, taking the most moderate view of the matter, the average gain to the manufacture by conditioning will be not less than five per cent, and this loss (if he does not condition) cannot be recovered in any subsequent stage, so that his foreign competitor has in this respect alone an advantage over him of at least five per cent. Allow me to conclude this lecture by stating in a few words how conditioning is carried on. Silk being an exceedingly hygrometric substance—its moisture varying constantly with the amount of humidity and the temperature of the atmosphere—the first operation is to ascertain the total amount of water it contains, for which purpose samples, carefully selected from the bale when it reaches the conditioning house, are weighed in delicate scales, dried in hot-air stoves, and re-weighed, the excess of moisture (beyond the 10 per cent. admitted to be the average normal quantity) being then easily calculated. The second operation carried out in the conditioning house is that of boiling off the samples dried as above, and again drying and reweighing, to ascertain the quantity of soap, oil, sugar, acetate of lead, &c., added to give weight, and the result of this operation is to show a loss of 30, 35, and even 40 per cent., instead of about 21 per cent., which is the average amount of natural gum.

Proceedings of Institutions.

BACUP MECHANICS' INSTITUTION.—The following members of this Institution have been successful in the recent Examination in Chemistry, under the Science and Art Department of Government. *Inorganic Chemistry*:—W. H. Barr, William Lord, Henry Nuttall, and Geo. W. Sutcliffe, first-class Queen's Prize; Geo. H. Stewart, James Walsh, and J. L. Wolfenden, second-class Queen's Prize; and Robert Stewart, third class Queen's Prize. *Organic Chemistry*:—William Lord, second-class Queen's Prize; Henry Nuttall, G. W. Sutcliffe, and James Walsh, third-class Queen's Prize; W. H. Barr and J. L. Wolfenden, honourable mention; and G. H. Stewart and Robert Stewart passed.

KENT ASSOCIATION OF INSTITUTES.—A meeting of delegates, from Institutes in the county of Kent, was held at the Faversham Institute, on the 7th of July. The following Institutions were represented:—Ashford Mechanics' Institute, Mr. Whitfield; Canterbury Church of England Young Men's Literary Association, Mr. W. D. Furley; Chatham Mechanics' Institute, Messrs. H. G. Adams and F. Butler; Faversham Institute, Messrs. F. W. Monk, J. A. Anderson, C. Smith and J. Tong; Ham-street Mutual Improvement Society, Mr. Wiglesworth; Lenham Mutual Improvement Society, Mr. Smirthwaite; Ramsgate Church Institute, Rev. F. G. Hazlewood and S. Coburn; Ramsgate Working Men's Club, Mr. G. M. Hinds; Sheerness Institute, Mr. Shrubsole; and Sittingbourne Institute, Messrs. Webster and Perraton. The Mayor of Faversham occupied the chair, and after explaining the circumstances which induced the committee of the Faversham Institute to take the initiative in an effort to establish a Union of Institutes in Kent, he referred to the success which had attended such organisations as the Yorkshire Union of Mechanics' Institutes, the Lancashire and Cheshire Union of Institutes, the South Staffordshire Association, the Worcestershire Union of Educational Institutes, the Southern Counties' Adult Education Society, and the Metropolitan Association for Promoting the Education of Adults. He was of opinion that the advantages which might be derived from a well supported Union of Kentish Institutes were so numerous and important, that a consideration of them would lead to the immediate adoption of a proposal which he was about to submit to the Conference. A County Association of Institutes might—1. Publish annual or quarterly reports of the proceedings of the various Educational Institutes in Union. 2. Appoint organising officers to visit Institutes, in order to assist and advise the managers. 3. Encourage persons to undergo the Society of Arts and other Examinations. 4. Offer prizes for Papers and Essays on various useful subjects. 5. Assist in the formation of village libraries. 6. Circulate a list of gentlemen willing to give gratuitous lectures. 7. Supplement the programmes of examinations prepared by various Educational Societies. 8. Improve and strengthen insufficient and feeble Institutes. 9. Promote the establishment of Institutes where none at present exist. 10. Originate methods of rendering the means of intellectual improvement attractive, and at the same time efficient. 11. Hold Conferences for the interchange of experience. 12. Award certificates to encourage persons to avail themselves of the advantages afforded them by Classes and Libraries. 13. Devise means for promoting Physical Education. 14. Remove various obstacles which now impede the progress of Institutes. 15. Constitute a Board of Reference on matters affecting the work of Institutes. 16. Facilitate the holding of Industrial and other Exhibitions. 17. Secure tuition for classes. 18. Lend diagrams for the illustration of lectures. 19. Give publicity to the operations of the Institutes; and, 20. Impress upon the public generally the importance of encouraging the education of youths and adults, especially among the working classes. The chairman concluded his address by moving the following resolution, which was seconded by Mr. Adams, and unanimously adopted:—"That a Union be formed of the several Literary, Scientific, Mechanics, Working Men's Mutual Improvement, and other Institutes of a similar character in the county of Kent, to be entitled 'The Kent Association of Institutes.'" Various resolutions respecting the objects and management of the Association were submitted and approved by the Conference. Rules were drawn up and a Provisional Committee appointed.

EXAMINATION PAPERS, 1864.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

(*Continued from page* 576.)

GEOMETRY.

THREE HOURS ALLOWED.

1. Draw a straight line perpendicular to a given straight line of an unlimited length, from a given point without it.

2. If a straight line falling on two other straight lines make the alternate angles equal to each other, these two straight lines shall be parallel.

3. To a given straight line apply a parallelogram which shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

4. If the square described upon one of the sides of a triangle, be equal to the squares described upon the other two sides of it; the angle contained by those sides shall be a right angle.

5. Divide a given straight line into two parts, so that the rectangle contained by the whole and one of the parts shall be equal to the square of the other part.

6. The angle at the centre of a circle is double of the angle at the circumference upon the same base, *i.e.*, upon the same part of the circumference.

7. Upon a given straight line, describe a segment of a circle which shall contain an angle equal to a given rectilineal angle.

8. Inscribe a square in a given circle.

9. Equal triangles, which have one angle of the one

equal to one angle of the other, have their sides about the equal angles reciprocally proportional

10. Describe a rectilineal figure which shall be similar to one and equal to another rectilineal figure.

11. The rectangle contained by the diagonals of a quadrilateral figure inscribed in a circle, is equal to both the rectangles contained by its opposite sides.

12. If a solid angle be contained by three plane angles, any two of them are greater than the third.

PROBLEMS.

1. If the straight line bisecting the exterior angle of a triangle be parallel to the opposite side, show that the triangle is isosceles.

2. Given the middle points of the sides of a triangle, construct the triangle.

3. Circles are described on the sides of a quadrilateral as diameters; show that the common chord of any adjacent two is parallel to the common chord of the other two.

4. No parallelogram, except a rectangle, can be inscribed in a circle; prove this.

5. If through any point in the common chord of two circles which intersect each other, there be drawn any two other chords, one in each circle, their four extremities shall all lie in the circumference of a circle.

6. Find the centre of a circle cutting off three equal chords from the sides of a triangle.

7. The straight lines which connect the angular points of a regular pentagon, which are not adjacent, intersect in the angular points of another regular pentagon.

8. If an equilateral polygon be described about a circle it must necessarily be equiangular, if the number of sides is odd, but not otherwise.

9. Describe a circle which shall touch a given straight line at a given point, and bisect the circumference of a given circle.

10. Find a mean proportional between two similar right-angled triangles, which have one of the sides containing the right-angle common.

MENSURATION.

THREE HOURS ALLOWED.

1. A floor is 27 ft. 4 in. long and 18 ft. 6 in. broad, find its area and its cost at 12s. 9d. per yard—

(1) By duodecimals.
(2) In any other way.

2. A metre is equal to 39·37 inches, an are is a decametre square, and a litre is a cubic decimetre; compare an are with an English acre, and a litre with a gallon.

3. The altitude of an equilateral triangle is to its base as 13 to 15 nearly.

4. What must be the proportions of a sheet of paper so that when it is folded in half it may still retain the same shape?

5. If A B C D be a trapezium, and C E and D F perpendiculars upon the base A B, prove that

$$2\,\text{A B C D} = \text{A E} \times \text{D F} + \text{B F} \times \text{C E}.$$

How must this proposition be modified if the perpendiculars fall, not upon the base, but upon the base produced?

6. The end of a rectangular beam is 1 ft. 2 in. by 1 ft. 8 in., its solid content is 18 ft. 33 in.; find its length by duodecimals.

7. Lay down the plan of a field and find its area from the following notes:—

	240	
144	190	
	122	116
120	60	
28	0	62

8. An acre of ground, which is an exact square, is to be enclosed with a wall 6 feet high and $2\frac{1}{2}$ bricks thick; find its cost at 5s. 3d. per square yard.

9. If ten equal circles be arranged round another circle so that each of them touches the two adjacent circles and the inner one, prove that the area of all the circles together will be equal to three times the area of the inner circle.

10. What weight of oil, specific gravity 0·925, is contained in a cylindrical vessel whose diameter and height are each 30 inches?

11. If a sphere be inscribed in a cube the surfaces are to one another as their volumes.

12. A cylindrical column, 10 ft. high and 3 ft. in diameter, stands upon a pedestal 6 ft. high, the top of which is a square 3 ft. in diameter, and the base a square 8 ft. in diameter; find the cost of painting the whole at 10d. a yard.

13. Find the solid content of a frustum of a pyramid in terms of its height and the areas of its top and bottom. Shew that this is greater than the solid content of a prism of the same height, whose base is the section of the pyramid at equal distances from the top and bottom.

TRIGONOMETRY.

THREE HOURS ALLOWED.

1. In any triangle A B C, the sides being $a\ b\ c$, show that—

(1.) $a^2 \text{ Sin. } 2\text{ B} + b^2 \text{ Sin. } 2\text{ A} = 2\,ab, \text{ Sin. C.}$
(2.) $(a^2-b^2) \text{ Cot. C} + (b^2-c^2) \text{ Cot. A} + (c^2-a^2) \text{ Cot. B} = 0.$

2. A person at 100 feet from a column observes that it subtends an angle of 45° at his eye (5 feet from the ground); find the height of the column.

3. Find x from the equation—

$$4 \text{ Sin.}^2 30 + \tan^2 45 + \text{Sec.}^2 30 = x \text{ Cosec. } 30 + 16 \text{ Sin.}^2 18.$$

4. If $a = 2$; $c = 3$; log. 3 = ·4771213; Log. Sin. A = 9·5228787; find angle C.

5. Two wheels with fixed centres roll upon each other, and the circular measure of the angle through which one turns gives the number of degrees through which the other turns in the same time. Compare the radii of the wheels.

6. If $\frac{\text{Sin. (A} - \text{B)}}{\text{Sin. B.}} = \frac{\text{Sin. (A} + \text{C)}}{\text{Sin. C}}$; A, B, C, being any angles, then

$$\text{Cot. (A} - \text{B)} + \text{Cot. (A} + \text{C)} = \text{Cot. B} - \text{Cot. A.}$$

7. If $\frac{\text{Sin. } x}{x} = \frac{2165}{2166}$ find x; and show that it is very nearly the circular measure of 3°.

8. If the sines of the angles of a triangle be in arithmetic progression, the cotangents of the semi-angles will be so also.

9. If $\tan. 3a = (2 + \sqrt{3}) \tan. a$, find tan. $3a$; and shew that $64 (\text{Cos.}^8 a + \text{Sin.}^8 a) = \text{Cos. } 8a + 28 \text{ Cos. } 4a + 35$.

10. If in a triangle—

$a \tan. \text{A} + b \tan. \text{B} = (a + b) \tan. \frac{1}{2} (\text{A} + \text{B})$, then shall $a \text{ Cos. B} = b \text{ Cos. A.}$

11. In a spherical triangle prove that—

$$\text{Cos. A} = \frac{\text{Cos. } a - \text{Cos. } b \text{ Cos. } c.}{\text{Sin. } b \text{ Sin. } c.}$$

12. Deduce from this Cos. a, in terms of the cosines and sines of A, B, C; demonstrate the proposition on which your proof depends.

13. If in a spherical triangle A = B = 2 C, then $8 \text{ Sin.} \left(a + \frac{c}{2}\right) \text{Sin.}^2 \frac{c}{2} = \text{Sin.}^3 a. \text{ Sec.} \frac{c}{2}$.

14. If E = the spherical excess in a right-angled triangle, C = 90°.

$$\text{Sin. } \tfrac{1}{2} \text{ E} = \frac{\text{Sin. } \frac{1}{2} a. \text{ Sin. } \frac{1}{2} b}{\text{Cos. } \frac{1}{2} c}$$

$$\text{Cos. } \tfrac{1}{2} \text{ E} = \frac{\text{Cos. } \frac{1}{2} a. \text{ Cos. } \frac{1}{2} b}{\text{Cos. } \frac{1}{2} c}$$

CONIC SECTIONS.

THREE HOURS ALLOWED.

SECTION I.—GEOMETRICAL CONICS.

1. Define (1) a tangent, (2) a normal, to a parabola. If S is the focus, P a point on the parabola, and the tangent and normal at P meet the principal axis at T and G respectively, prove that ST = SP = SG.

2. Prove that the locus of the middle points of a system of parallel chords in a parabola is a straight line parallel to the principal axis. What is the analogous theorem in the ellipse?

3. Prove that the parameter of any diameter of a parabola is four times the focal distance of the corresponding vertex.

4. Prove, by the properties of the cone, or otherwise, that in the ellipse the square of the ordinate varies as the rectangle contained by the segments of the major axis ($MP^2 : AM \times MA' :: BC^2 : AC^2$).

5. If T is the point of intersection of the tangent of an ellipse with the major axis produced, then $CT \times CM = CA^2$. Also, prove this theorem by means of projecting a circle into an ellipse.

6. Define conjugate axes, and show that the sum of the squares of a pair of conjugate axes is constant.

7. Prove in the hyperbola that SP — HP = 2CA. By what section of a cone is a hyperbola formed?

8. Draw a tangent to a hyperbola (1) at a point in the curve; (2) from a point outside the curve. Can these problems be done by the ruler only?

9. If a line touches a hyperbola, and is terminated by the asymptotes, show that it is bisected at the point of contact.

10. Find the value of the radius of the circle of curvature at any point of an ellipse.

SECTION II.—ANALYTICAL CONICS.

11. Determine the tangent of the angle contained between the two lines $ax + by + c = 0$, $a'x + b'y + c' = 0$.

12. Find the equation to the tangent of the circle $y^2 + x^2 - 2ax = 0$; prove that it is perpendicular to the radius of the point of contact, and that the perpendicular from the origin on it is equal to the abscissa of the point of contact.

13. Prove that the normal to the ellipse bisects the angle between the focal distances. What is the analogous theorem in the hyperbola?

14. If (x, y) is a point on an ellipse, prove that $\left(-\frac{a}{b}\frac{y}{}, \frac{bx}{a}\right)$ is the conjugate point. Hence deduce the truth of No. 6 in the preceding section.

15. Find the polar equation to (1) the parabola, (2) the ellipse, the focus being the pole in each case.

16. Prove that the perpendicular from the focus to the tangent of a parabola is a mean proportional between the least distance and the radius vector of the point of tangent.

17. Prove the theorems contained in 5, 7, 9, of the preceding section.

18. Show that the equation to a hyperbola may be put into the form $xy = k^2$.

(To be continued.)

Fine Arts.

FINE ARTS IN PARIS.—Amongst the pictures purchased by the Imperial government, and now placed in the gallery of the Luxembourg, is the grand work of Meissonier, "Napoleon III. at the Battle of Solferino." This picture, which measures perhaps twenty by ten inches, is four times larger than any former production of the same artist, and it and its companion of the late exhibition—"Napoleon I. in the French Campaign of 1814"—have enormously increased the popularity of Meissonier. Before these appeared he was the pet of the connoisseurs; now he is, perhaps, the most popular painter in France. He is, however, not at all inclined to repose on his laurels; on the contrary, he seems determined to follow the very unusual course of abandoning his peculiarity, throwing off his mannerism, and trying his skill in the common arena. He is now engaged, it is said, on a large canvas, the subject being "A Charge of Dragoons in presence of Napoleon I." It will be a grand triumph if he should succeed in producing as much effect in a new manner as he has in his own extraordinary one, and there is room to hope that he may do so. He already possesses qualities which few artists combine in their works; his taste is evidently towards repose; most of his best known figures are sitting, lounging, tranquil; but, on the other hand, he has produced two, if not more, works in which the action is most energetic. Everyone knows the wonderful picture called the "Lutte," in which two men who have quarrelled over cards are being separated by their companions; the expression of rage and the fierce action exhibited in every muscle, could scarcely be surpassed. Should Meissonier succeed on a large scale as he has in his wonderful miniatures, he will take rank with the greatest artists in Europe. His attempt even must have a good effect. The huge military subjects which have of late years covered the walls of the Paris Exhibition undoubtedly sometimes exhibit much talent and daring execution, but in an artistic point of view they present little for admiration; occupying acres of canvas they are at once small and coarse in treatment, the details in general laboured, and the colouring glaring and inharmonious. In Meissonier's "Solferino" the details are painted as if under a microscope, and yet the effect of the picture is broad and grand, while many of the large works alluded to are crowded and confused to a painful extent.

ART UNDER DIFFICULTIES.—One of the greatest curiosities of the Louvre at the present moment is the sight of an artist born without hands or arms, copying the works of the great masters, and copying them with great success. The way in which he has tutored his feet to the work is so extraordinary that on looking at him one can scarcely divest oneself of the feeling that nature, by way of compensation for the absence of the upper limbs, must have furnished the lower with muscles and nerves of unusual power and delicacy. The name of this artist is Felu; he is Belgian by birth, and has studied in the Academy of Antwerp, which he entered in 1859. His application for admission at once secured the attention of the director, M. De Keyser, by the great beauty of the penmanship, and when it was found that the pen had been held between the toes instead of the fingers, the surprise was great. He was immediately admitted into the classes, made rapid progress, and exhibited remarkable ability. But even more extraordinary than a painter without hands is a sculptor without eyes; M. Vidal, well-known for some years in Paris, and who has produced some extremely clever models of animals in terra-cotta, is completely sightless, yet such is the perfection to which he has educated the sense of touch, that he models both with accuracy and facility. The preliminary study must have been long and laborious, especially if, as we believe, M. Vidal was born blind, or lost his sight at an early age. M. Martin, a sculptor, whose busts are well known and deservedly admired, is deaf and dumb. It would be difficult to find three other instances equally extraordinary and interesting of the pursuit of art under difficulties, in two cases, at least, apparently almost insurmountable.

DISCOVERY OF SUPPOSED WORKS OF HOLBEIN.—A curious discovery has been made at Lucerne; in removing some old woodwork in a mansion known as Corrazioni d'Orelli, a ceiling has been discovered, richly ornamented with carved work and painted in fresco. The subjects include the Annunciation, the Resurrection, the Ascension, Saint John the Baptist, Saint Béat, and Saint Rocha,

bishop holding a spit on which his entrails are wound, and another bishop in the act of consecrating a chalice on which a spider is depicted. These paintings bear the date of 1523, and as Holbein decorated several houses at about that period at Lucerne, and from the evidence of the works of themselves, artists believe the paintings to be his production.

MONUMENT TO H. FLANDRIN.—A commission, which includes Comte Walewski, M. Ingres, and Baron James Rothschild, has just been formed to raise a subscription for a monument to the memory of the late able artist, Hyppolyte Flandrin. The *Institut* of France, the House of Rothschild, and the *Gazette des Beaux Arts*, receive subscriptions.

SALE OF THE COMTE DE CHAMBORD'S COLLECTION.—It is positively asserted that the Palace de Vendramin, in Venice, the property of the Comte de Chambord, with the fine collection of works of art which it contains, is shortly to be sold by public auction. Amongst the works of the modern French school are two famous pictures by Horace Vernet—"The Dog of the Regiment," and "The Trumpeter's Horse."

FINE ART IN ITALY.—The government at Turin has decided that the fine old palace of the Podestat at Florence (St. Bargello), shall be converted into a national museum of the works of art of the Middle Ages. This palace, one of the finest buildings in Italy, has been many years used as a state prison; it is now to be completely restored, and the carrying out of the work is entrusted to the Chevalier Mazzei. A special commission is appointed to collect and arrange the museum itself, the nucleus of which will consist of the collections now at the Palaces Pitti and Uffizj. Two galleries, one devoted to sculpture and the other to armoury, are ready to be thrown open to the public; the latter contains, amongst other things, complete equipments of the knights of the Black Bands. A professor's chair of archæology is to be attached to the museum.

CATALOGUE OF THE ERMITAGE COLLECTION AT SAINT-PETERSBURG.—Baron Kohne, one of the keepers of this collection, has just published a new collection of its contents, which includes from seven to eight thousand works, of which about one quarter are indicated as of high merit; of these 327 are Italian, 944 belonging to the various Teutonic schools, 115 Spanish, 172 French, 8 English, and 65 Russian; Murillo is represented by no less than 20 works, Rembrandt by 41, and Rubens by 60.

HENRI II. WARE.—M. Benjamin Fillon, of Niort, who has just published a work entitled *L'Art de terre chez les Poitevins*, has made a rude attack on one of the cherished notions of the connoisseurs of old earthenware; he declares, and it is said that his proofs are conclusive, that the famous set of table ware supposed to have belonged to Henri II. of France, and of which nearly the whole of the pieces known to be in existence were collected in the South Kensington Museum in 1862, and which have been sold from time to time at fabulous prices, was made about the year 1530, in the little hamlet of Oiron, near Thouars, for, and under the direction of, a lady named Hélène de Hangest, a widow who exhibited great love for, and taste respecting, objects of art. If M. Fillon be correct, some people will not thank him for the discovery, and especially the publication of it.

SCHOOLS OF ART.—The report from the select committee appointed to inquire into the constitution and working of schools of art has been issued, and the recommendations are:—"That a central training school for teachers be maintained as at present, and sufficiently qualified scholars from local schools be admitted to the training school at the expense of the state, the study of decorative art useful for manufactures being the primary object; other scholars should also be admitted to the training school upon payment of remunerative fees. That the collection of works of decorative art at South Kensington be made more generally useful than at present throughout the country, especially in connection with local museums. That a national competition of works from all the local schools of art in connection with the department continue to be held annually at South Kensington, and a limited number of prizes awarded. That local schools of art be left to establish themselves wherever they can take root, and to extend their operations to all classes of society, and to charge such fees as their managers may think suitable. That the conditions of granting any state aid to local schools of art be:—(*a*) that night classes for artisans be open at least three times a week, at fees within the reach of artisans; (*b*) that the teachers be certificated, and receive the whole of the fees of the artisan classes; and (*c*) that the localities provide suitable premises, and pay all charges for rent, taxes, and repairs. That no further grants be made in aid either of building, renting, or repairing schools of art. That no further grants be made in aid of purchasing examples, models, casts, or apparatus. That it be a condition of government aid that a public examination of every aided school of art be held annually, through the agency of its local committee, and that the results of such examination should be reported to the department in such form as the department may prescribe. That payments to certificated art teachers should be so far assimilated to those made to teachers of science, that a capitation payment should be made for every artisan student who has received 40 lessons within the year. That the works of the students in their examination, certified by two members of the local committee as being the students' own work, should be sent up to the central department. That fewer prizes and no medals should be given by the central department on local examinations of aided schools of art. That if ever an inspector reports that an aided school of art is held in unsuitable premises, or uses bad models, examples, or apparatus, or that the teaching is deficient, aid may be wholly or partially withheld until the local committee consent to make such changes as are deemed essential to the proper conduct of the school. That the votes for the museum at South Kensington and for the schools of art should be kept distinct."

Manufactures.

NORTH LONDON WORKING CLASSES' INDUSTRIAL EXHIBITION.—This undertaking is under the patronage of the Earl of Shaftesbury, Mr. W. H. Bodkin, Assistant-Judge, and other gentlemen of influence. The Committee have issued an address, in which they say:—It will scarcely be deemed otherwise than a natural consequence of the success which attended the Exhibition in Lambeth, that similar attempts should be made in other metropolitan districts. While, therefore, the Committee feel it incumbent upon them to acknowledge the obligation they are under to the promoters of the Lambeth Exhibition for the origin of the idea, they deem it unnecessary to offer any apology for undertaking its further development. Although the nature of the proposed Exhibition is sufficiently indicated by its title, it may be stated, to obviate any misapprehension, that the objects to be exhibited must be the production of the Exhibitor. Such objects will include—I. Articles manufactured in the ordinary way of business, which should, of course, be specimens of superior workmanship or novel design. II. New inventions or original contrivances to economise labour and time. III. Useful, artistic, or ornamental articles which may have been produced in spare hours, whether by working men or working women. The term "North London" is intended to include the districts of Clerkenwell, Islington, St. Pancras, St. Luke's, Hoxton, and St. Andrew's, Holborn. The Exhibition is arranged to take place at the Agricultural Hall in October next. The Committee now, therefore, invite immediate application for space from intended Exhibitors, and earnestly solicit the hearty co-operation of the working classes generally. Printed forms of application for space are

issued free to all applicants by the Secretary, Mr. Watts, 7, Birchmore-terrace, Cardington-street, and others. The time of admission to the Exhibition will be from seven till ten each evening, and the admission will be 2d. each person. On Mondays and Wednesdays the Exhibition will be open from ten till five o'clock, 6d. for each person; children, 3d.; and on Saturdays, from ten till three o'clock, at 6d. each, and from five till ten o'clock, 2d. each. Previously to the opening of the Exhibition, a number of gentlemen, unconnected with the management, will be invited to meet the Committee and award Prizes of Merit (not pecuniary) to the Exhibitors.

THE INDUSTRY OF PARIS.—The Chamber of Commerce has just published a report, which contains a comparison of the statistics of Paris industry of 1860 and 1850. It appears by this document that the number of manufacturers in Paris is 101,171, of whom 87,850 are within the old limits of the city, and 23,321 in the recently annexed communes. Of these only 7,492 employ more than ten workmen each, 31,480 have from two to ten men under them, while 62,199 employ only one workman or none at all. The annual value of the productions of these 101,171 manufacturers is set down at 3,369,092,449 francs per annum, or about 33,690 francs (£1,347) on an average for each. The total aggregate rent paid is said to be 107,390,710 francs, or, on an average, £43 a year. The labouring class employed in this industry is stated at 488,081 persons, of whom 355,692 are men, 126,134 women, and 26,255 children. The average rate of wages of the men amounts to 4fr. 35c. a day, and that of the women to 2fr. 1c. Out of a hundred workpeople, 71 have their own furnished apartments, 18 live in ready furnished lodgings, and 11 live with their employers; and 67 can read and write. The steam power employed is said to consists of 1,185 engines of, together, 9,748 nominal horse-power; and the number of sewing machines to amount to 2,097, furnishing employment to 21,000 workwomen. Of course this does not include the sewing machines used elsewhere than in recognised workshops.

SPINNING SCHOOL AT MULHOUSE.—A school for teaching weaving was established at Mulhouse three years since, and has been eminently successful; the same principle of industrial education is now being applied to spinning, a school for that purpose being now in process of organization in the same town, and will be ready to receive pupils in October, when the regular winter educational session commences. The Alsacian manufacturers exhibit great wisdom and foresight in these establishments for technical education, than which nothing is so likely to conduce to the maintenance and improvement of their manufacture. The great centres of English production should study with attention these important movements.

SUGAR MANUFACTURE.—Messrs. Travers and Son, in their circular, quote a paragraph from the *Morning Post*, stating that "Accounts from Havana mention that M. Reynoso, the distinguished Cuban chemist, had left for Europe in a British steamer, to perfect a discovery of his, which, it is alleged, is to work a revolution in the manufacture of sugar. The problem the inventor thinks he has solved is one that has occupied the attention of chemists for years, and consists in so treating the fresh cane-juice that there shall be no residue, but all be converted into sugar of equal quality and fineness. M. Reynoso's friends have subscribed 35,000 dollars to enable him to prosecute his researches and experiments in Europe. Should he succeed, all sugar-planters will probably conform to the new system, and no more Muscovadoes will appear in the price current." In commenting on this statement Messrs. Travers say:—"The writer evidently did not read that part of our Chancellor's financial statement in which he distinctly avows his intention so to adjust the duty here as to put the English refiner and the refiner abroad on equal terms, and forgets that he has shown his good will by making the English consumer pay 12s. 10d. per cwt. on all foreign refined sugar, but only 8s. 2d. upon Indian Jaggery. If, therefore, M. Reynoso succeed, as we sincerely hope he will, in perfecting his discovery, he must recollect that whilst Mr. Gladstone is in power his invention will only close our market more firmly than ever to his Cuban sugars, and that if the latter are to be made all pure and all white at but slight extra cost, the Chancellor's principles of political economy, which demand that the foreign and home refiner shall be handicapped, will force the public here to pay an extra tax before it can use these pure white sugars. If the economy of Mr. Reynoso's process be so great as to more than countervail this protection, Mr. Gladstone's well-known consistency will prompt him to raise this protection to whatever point may be necessary."

INDIA RUBBER TELEGRAPH WIRES.—Messrs. Wells and Hall are now manufacturing, for Government telegraphs, India rubber covered wires, which consist of a No. 18 (diameter ·043) tinned copper, insulated to a total diameter of ·25-inch. Weight of copper per mile, 30lb; weight of insulator per mile, 60lb. The resistance of the insulating medium for one mile, tested in water at a temperature of 60° Fahr., is 4,750,000 Siemen's units; and the resistance of the conductor 54 Siemen's units. The insulation tests, both static and dynamic, appear to be of a high character in comparison with results obtained on other materials. No tar is to be applied to this core, on account of its deteriorating effects when brought into contact with the rubber.

Commerce.

THE CURRANT TRADE.—A letter from Patras, dated 28th June, says that, "on the whole, the fruit is progressing very favourably. The total yield, partly owing to the increasing production of the young plantations in the Morea, promises to exceed that of all former years. Until within the last two days the weather has been unusually cool, retarding the fruit, which even in the early districts is, at least, a week later than last season; the change to hot weather, however, may cause it to fill out more rapidly than usual, and diminish the difference. The blight, favoured by the damp atmosphere, has developed itself with much force this season, and several applications of sulphur have been required to check it. Prices, we have every reason to expect, will be very moderate. With regard to the export duties, it is almost certain that they will remain unaltered for this year, notwithstanding the annexation of the Ionian Islands to Greece." Another letter from Zante, of the 30th June, says:—"The cultivation and sulphuring of our currant vines have been attended to with the usual care, so that although, from the blighted appearance of non-sulphured plants, it is evident that the blight is as virulent as ever, still, as in former years, we are not apprehensive of any ill results to our currants. There is an abundant show of well-grown bunches of fruit on our plants, and our prospects for quantity and quality are about on a par with what they were at the same season last year. When it is taken into consideration, therefore, that last year the weather at the latter stage of the season was not over favourable to the proper ripening of the fruit, and that the greater part of it was ultimately caught by rains on the drying grounds, it may be safely inferred that if this year we are favoured by the weather to the end, we shall have a slight increase on the quantity produced last year of about 6,400 tons, and have, moreover, a finer and cleaner quality of fruit. Notwithstanding the cession of these islands to Greece, no change has yet been made in our duties, and none can well be made before the new constitution is drawn out and other formalities gone through."

THE SUGAR TRADE.—The following communication from Brussels appeared in the *Journal de Liège* of the 1st July:—"It is known that a French Commission,

composed of Messieurs Herbet, Ozenne, and Barbier, have been entrusted by their government to prepare a scheme of international legislation with regard to sugar. After having commenced their labours by a visit to Holland, they arrived yesterday at Brussels, and are now engaged in conference with the Minister of Foreign Affairs, M. le Baron Lambermont, the Secretary-General of this department, and with Messieurs Fisco and Guillaume, superintendents to the Finance Minister. It is believed that the French delegates have every prospect of success, and it would appear that we may hope for the speedy realization of the Sugar Zollverein, that France aims at, in which Belgium is equally interested. From here (Brussels) the delegates will proceed to England."

THE FLAX CROP ON THE CONTINENT.—The "Belfast Linen Trade Circular" states, with regard to the districts south and north of Holland, Zealand, and North Braband, it is the general opinion that fully as much flax seed has been sown as in 1863; that more acres have been sown with first growth from Riga seed, than with Riga seed, and that the crop in general can only be called middling. In the Biesbos (North Braband) about 600 acres have been sown, of which three-fourths may turn out a first-rate crop with good seed. In the Haarlemmermur the crop looks well enough, and though the length is somewhat irregular, the, quantity and quality are expected to be but very little beneath 1863. Prospects for seed are favourable. The crop in the Hockschen Warrd and Brielsch Island, where flax has been sown to a greater extent than last year, is considered below an average one, and some early sown districts have come up rather sparingly and irregular; but the flax has obtained a good length, and the prospects for seed are fair. In the Western part, flax has suffered much by hail, but the latter sown, which came up somewhat too full, suffered by grub, and has been beaten down by the late rains. In North Braband, the growth is even below an average, excepting some fields which failed totally; the flax is in general thin and short, and has, with few exceptions, suffered by grub, so that prospects are anything but favourable. The great damage done to several fields is principally owing to the cold, rainy, damp weather. The crop is estimated one-third less in weight, and thereby quality has suffered in proportion. In the so-called "sand districts," where also some flax has been sown, a small crop is expected. In North Holland, where the same number of acres has been sown as in 1863, the early sown has come up rather short, and not full enough; amongst the latter sown there are some good fields, but generally speaking, only a middling crop is expected. In the West land, sowing is equal to last year; the flax is thin, and even below an average. In the Island Ysselmonde, more was sown than last year, and flax may be called good; growth regular, of a fair length, and prospects are favourable for the seed crop. In the Western parts, many fields have suffered by hail. In Zealand, much flax has been sown again; in most districts it is short and thin, and though in other parts it is somewhat better, it may still be said that prospects in general are not favourable.

WOOL.—The third series of this year's public sales of colonial wools was fixed by the importers to commence in London on the 21st inst. Judging from the present arrivals the quantity to be offered at sale will probably reach 140,000 to 150,000 bales, and notwithstanding that a certain proportion is likely to be held over for the November sales, this will be the largest on record. Considering the enormous scale on which consumption keeps going on, and the generally small stocks in manufacturers' hands, very firm, and some think even higher prices than those obtained at the close of the last sale may be expected, especially as the monetary market has since become more easy. Our domestic wools have nearly recovered the decline from the high prices ruling until clip time, which they experienced, and will probably continue to improve.

Colonies.

SALMON IN TASMANIA.—The introduction of salmon into Tasmania may now be regarded as *un fait accompli*. About 30,000 healthy ova were placed in the breeding ponds between the 21st and 23rd April. The first fish made its appearance on the 5th May, and since then there were 100 healthy young salmon swimming in the pond. A number were brought into existence with crooked backs, and these of course died; and it now appears that it would have been much better if some of the ova had been more slackly packed. The tightly-packed boxes were not in so good condition as the more slackly-packed ones. The hatching of the trout was complete, but their number is not stated. The little fishes are remarkably healthy, only one of the whole number hatched having died. The Melbourne papers say that several of the salmon ova have been hatched there.

THE BOARD OF AGRICULTURE at Melbourne have decided to offer premiums as follows:—£30 for the best and £20 for the second best sample of cotton grown in the country of not less than half-a-hundred weight, the same to become the property of the Board, for the purpose of being forwarded to England to test its value as an article of export; £20 for the best sample of silk produced in the colony; £15 to the person or persons who had most turned public attention to the subject in the year 1863-4; and £15 to the person who shall have done most to the cultivation of the white mulberry in the same period; £30 for the best, and £20 for the second best, for the owner of a hop garden; and £30 for the best sample of hemp, and £20 for the second best. The recommendation of a sub-committee, that £10 should be appropriated to purchasing Durham mustard seed was adopted; but a recommendation to grant a premium for the best sample of colonial flax was rejected on the ground that flax could not be grown profitably in Victoria at anything like the present and prospective rate of wages.

COMMERCE IN SOUTH AUSTRALIA.—During the earlier part of April there was a steady improvement in most imported goods, but later arrivals had given some check. Prices were, however, maintained, and with the present steady trade the effect was not likely to be felt for any length of time. There was, towards the close of the month, a falling off in the export of cereals, and there were no orders for shipping. However, the supply was very limited, and stocks in town and port were increasing but very slowly. It would require only a small amount of orders to cause a rise in prices, more particularly as the supply will decrease as the farmers begin to prepare the ground for sowing the next year's crop; and the rains having begun so late this season, but few of the growers would bring any wheat till the seed was all in. The reports from the mines in the north and south continue favourable, except those in Yorke's Peninsula. The miners have struck for wages, and it is feared it will be some time before matters are arranged. The vintage is finished in the plains, but in several of the large vineyards of the hills it has only just begun, and it is feared that the recent rains will have a deteriorating influence on the quality of the vines. With this exception, the grapes having well ripened, the produce of this vintage is superior to those of preceding years.

SHEEP.—An Adelaide paper says that during the fortnight preceding January 4, no less than 50,000 sheep from South Australia crossed the Darling for the stations on that river and on the Murrumbidgee and Loddon, and 100,000 more were expected to cross during the next three weeks.

CUSTOMS DUTIES IN CANADA.—The government proposes that on gin, rum, and on all other spirits except whisky, an additional specific duty of 15 cents per gallon be imposed. On whiskey 15 cents additional. On brandy 15 cents specific additional; and that on ginger wine, as a cordial, a duty of 20 cents per gallon be imposed hereafter.

The government proposes to raise an extra million of dollars this year, and this is one of the methods it intends adopting. Another is a stamp duty. This is new in Canada; it has always worked well in England, and does not affect the poor man. The law proposes to affect notes over 20 dollars, and all amounting to or under £100 will pay a stamp tax of only 3 cents. Bills of exchange will also pay only a tax of 2 cents. The amount is small, but will realise a considerable sum, and perhaps will prove the least burdensome method of assisting towards meeting the deficit in the revenue.

Notes.

THE DAVY MEMORIAL.—The inhabitants of Penzance are about to erect a monument to commemorate the services rendered by Sir Humphrey Davy to abstract and practical science. This proposal, which has the support of Lord Brougham, Professors Faraday and Williamson, Sir Charles Lemon, and many other men eminent alike in literature and science, has been long talked of; but the calls for help consequent upon the Hartley Mine catastrophe, the Lancashire distress, and several local accidents, have deferred its vigorous prosecution. Originally a very elegant monumental tower was proposed to be erected; but in consequence of two ladies offering the sum of £1,000 if the testimonial took the form of alms-houses, a memorial of that kind, in conjunction with a statue, has been determined upon. Since that time other sums have been offered, and the committee have now available funds to the extent of £1,400, which have been collected. When all that Davy accomplished for the benefit of science and humanity is taken into account, it appears a standing reproach to our country that no monument exists to commemorate his worth. His invention of the safety lamp, his application of the decomposing power of the voltaic battery to chemical research, and his brilliant discovery of the metallic bases of the alkalies and earths, which is the foundation of all modern chemistry, surely have as strong a claim to be commemorated in some permanent manner as the deeds of military heroes, however brave.

THAMES EMBANKMENT.—The foundation stone was laid in front of Whitehall stairs on Wednesday last, by Mr. Thwaites, Chairman of the Metropolitan Board of Works.

FISHING BY ELECTRIC LIGHT.—A first attempt was made to fish by electric light a short time since at Dunkirk. The light was supplied by a pile on Bunsen's principle, composed of about 50 elements, and it succeeded tolerably well, but the employment of the pile was attended with much inconvenience. It was then determined to repeat the attempt with a magneto-electric machine. The new experiments tried at Dunkirk and Ostend had a double object—1, to prove how the light produced by the machine would act under water; and, 2, to discover the effect the light would produce on the fish. The first object was completely accomplished, and it is now demonstrated that magneto-electric machines and the light they produce are applicable to all submarine works. In fact, this light was constant at 180ft. under water, and it extended over a large surface. The machine, nevertheless, was placed at a distance of more than 300ft. from the regulator of the electric light. The glass sides of the lantern remained perfectly transparent, and the quantity of carbon consumed was less than if it were in the open air.

COMBUSTIBLE GOODS.—A merchant at the East end of London has been fined £20 for having sent by the North-Western Railway a package containing highly combustible goods ("blazing fusees"), without giving notice that they were dangerous.

Correspondence.

SAFETY IN RAILWAY TRAINS.—SIR,—In the report read at the General Meeting of the Society no mention was made of the committees appointed some time since, nor was any allusion made to them during the meeting. Probably they are supposed to be defunct, and if so, if I may judge from the Mechanical and Engineering Committee, the difficulty has been to bring forward definite and practical objects on which the attention of the committee might be brought to bear. It has occurred to me that even if nothing else presented itself, one object alone might well receive the attention of the Mechanical Committee, and if it be defunct it would be worth reviving it, for the purpose, namely, to consider the best means of giving railway passengers the means of communicating with the guards of the train. The recent tragedy cannot but draw public attention again to the subject, and it would be useless to lengthen this letter by referring to other instances in proof of its desirability, or more correctly, its necessity. Many letters and suggestions have, and no doubt still will, appear in the public press, proposing apparently simple but really crude and impracticable plans of meeting the difficulty, most of which have been thought of and exploded many years since, as they overlook the essential point of any practicable plan, which is, to enable passengers to communicate with the guard without stopping the train, giving the guard alone the means of communicating with the engine driver. Some years since a murderous attack, which happened also on the North London Railway, led me to bring forward a scheme, which I laid before some of the principal officers of our chief railways. They all received me with courtesy and gave it their attention; some of them distinctly expressed their approval of it, but candidly told me the railway directors would never adopt anything of the kind until forced to do so by the public. The public press also spoke favourably of my plan, and it was exhibited at the Polytechnic Institution. In nearly every case on my first interview with the railway officials, I was met by the cogent objection, "That it would never do to give every nervous old woman the means of stopping the train when she happened to be frightened;" but I met such remarks by pointing out that the object I had in view was to enable passengers to communicate with the guards without stopping the trains, and this certainly must be the principle of any practicable scheme. My present purpose, however, is not to bring forward and describe my own plan, so much as to suggest that the Society of Arts should call together its Mechanical Committee for the definite purpose of considering the subject, and that they invite information and plans from all and any quarter, and should they on due consideration be convinced that any one or more practicable plans can be suggested, the committee should then propose that the whole influence of the Society of Arts be brought to bear on the public, on the legislature, and on the railway authorities, so as to secure a practical trial. The Society not long since took the initiative in the matter of artistic copyright, and were successful; certainly this subject is of equal importancee and falls as legitimately within the province of the Society, It is a matter which will never be satisfactorily deal. with by railway directors unless extraneous influencet oblige them. At the time I was endeavouring to draw attention to my plan, a well-known engineer told me that some years since he was commissioned by the directors of one of the principal railways to investigate the matter, and they invited communications on the subject. I think he said that about sixty plans were laid before him, some remarkable alone for their absurdity, such as shooting an arrow at the head of the engine driver, but others were made the subject of actual experiment. On some he reported favourably, and considered them quite practicable, and there the matter ended. It is just at this point a disinterested and influential body like the Society of Arts could bring its influence to bear by enforcing attention to the subject, and, if necessary, urging the legislature to interfere.—I am, &c., W. SYMONS.

17, St. Mark's-crescent, Regent's-park, July, 1864.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 11th and 13th June*, 1864.

142. Settled Estates Act Amendment.
High Court of Admiralty in Ireland Commission—Report of Commissioners.
New Zealand—Further Papers.
Education—Report and Appendix.
New Zealand—Papers relating to a Loan to meet the Expenses of the Native War.

Delivered on June 14, 1864.

349. Poor Relief—Report, &c., from the Select Committee, with Appendix.
143. Bill—Accidents' Compensation Act Amendment.
Transportation—Extracts of Despatches and Petitions from the Governors of the Australian Colonies.

Delivered on 15th June, 1864.

337. Shipping—Returns.
342. Yachts and Fishing Smacks—Return.
356. Greenwich Hospital—Memorandum.
357. Coals, Cinders, and Culm, &c.—Account.
363. Transfer, &c., of Land—Return.
51. Bills—Poor Law (Ireland) Acts Amendment.
139. ,, Municipal Corporations (Ireland).
144. ,, Greek Loan.
145. ,, Common Law Procedure (Ireland) Act (1853) Amendment (Lords Amendments).
146. ,, Lunacy (Scotland).
148. ,, Chimney Sweepers' Regulation.

Delivered on 16th June, 1864.

290 (I). Sheffield and Bradford Reservoirs—Report.
358. Public Income and Expenditure—Account.
366. Superannuation Act—Correspondence.
385. Ashantee War—Extract of Despatches.
386. Bankruptcy—Return.
388. Judgments (Courts of Common Law)—Return.
147. Bills—Local Government Supplement (No. 2).
149. ,, Pier and Harbour Orders of Confirmation (amended).
Poland—Communication with the French Government.
National Education (Ireland)—Thirteenth Report of the Commissioners.

Delivered on 17th June, 1864.

393. Cape Coast—Statements.
152. Bills—Portsmouth Dockyard (Acquisition of Lands).
153. ,, Poor Law Guardians' Elections.

Delivered on 18th and 20th of June, 1864.

381. Navy ("Ship Research")—Report.
382. Land and Marine Forces (Religious Denominations)—Return.
55. (VII.) Railway and Canal Bills—Eight Report.
260. (II.) Decimal System of Measures—Further Return.
384. Inclosure Commission—Special Report of the Commissioners.
390. National Education (Ireland)—Return.
392. Army (Manufacturing Establishments)—Return.
151. Bills—Naval and Victualling Stores.
157. ,, Punishment of Rape.
158. ,, Insane Prisoners Act Amendment (Lords Amendments).

Patents.

From Commissioners of Patents Journal, July 15th.

GRANTS OF PROVISIONAL PROTECTION.

Air-canes—1182—S. Dreyfous.
Air-engines—1578—M. Henry.
Alkalies, &c., processes for obtaining—1375—F. O. Ward.
Aniline colours—1669—G. Phillips.
Armour for ships, &c.—1659—J. H. M. Van Buren Whisker.
Bedstead—1586—W. E. Gedge.
Beer-engines—1606—W. Perks, jun.
Boilers, preventing incrustation in—1587—G. T. Sims and J. Pendley.
Bread-manufacture, machinery for—1588—W. A. Guy, E. Edwards, and R. W. MacArthur.
Bread-manufacture—1589—R. W. MacArthur, W. A. Guy, and E. Edwards.
Brick-making machinery—1667—B. C. Sykes.
Bubble-blowing apparatus—1613—W. E. Newton.
Candles, prevention of guttering—1607—H. C. Steane & F. A. Steane.
Clips for binding manuscripts, &c.—1600—H. Jenkins, J. Jenkins, F. Jenkins, and S. Jenkins.
Cops, machines for making—1635—J. Combe.
Distances, apparatus for ascertaining—1647—D. McCallum.
Drains and drain tiles—1608—W. P. Savage.
Engines, traction, &c.—1585—E. R. Turner and F. Turner.
Fabrics, machinery for producing knitted or looped—1592—W. Brown.
Fibrous substances, machinery for cleaning—1569—J. Holt.
Fire-arms—1645—A. Wyley and J. Grainger.
Fireworks—1655—W. E. Gedge.
Foot-lights for theatres, &c.—1643—C. Defries.
Forging machine—1549—I. Buckley and E. Crossley.
Frames for supporting threads, &c.—1590—W. H. Barwell.
Furnaces and boilers—1620—W. Clark.
Governors—1597—M. Henry.
Heating, &c., application of petroleum, &c., to—1599—B. F. Stevens.
Hydrostatic scales—1593—W. E. Newton.
India-rubber, vulcanising—1577—A. Turner and J. Clark.
Indicators for vehicles—1582—W. Adams.
Jib-sail rings—1629—R. Balans.
Kilns or ovens—1596—H. Chamberlain, J. Craven, & H. Wedekind.
Lamps, moderator—1611—W. Clark.
Lamps, paraffin—1580—J. Hinks and J. Hinks.
Land-cultivation, application of steam-power to—1626—W. Clark.
Leather, apparatus for shaving, &c.—1657—J. Lee.
Locks and keys—1679—A. B. B. Von Rathen.
Lozenges, manufacture of—1614—C. J. Tinker.
Meat, &c., preserving—1523—R. Jones.
Metal prepared by Bessemer's process, casting ingots of—1193—W. Weild.
Nuts, machinery for manufacture of—1628—R. A. Brooman.
Oakum, apparatus for manufacture of—1653—N. Jarvie & W. Miller.
Ornamenting wood and other surfaces—1583—W. Scarratt.
Oysters, apparatus for opening—1591—W. D. Napier.
Pottery, apparatus used in the manufacture of—1576—R. Cochran.
Printing machines—1555—W. Smith.
Pumps—1637—D. Gallafent.
Punches for making the eyes of needles—1528—G. Beard.
Railway carriages, &c., ventilating—1641—J. Langton.
Railway carriages and wheels—1671—J. E. Wilson.
Railway wheels and axles—1074—T. Cordukes and J. G. McGee.
Railways, permanent ways of—1673—J. E. Wilson.
Sails, apparatus for reefing, &c.—1639—T. Day, sen., and T. Day, jun.
Sewing machines—1609—W. F. Thomas.
Ships, machinery for loading—1598—W. E. Newton.
Spring hook or fastening—1575—W. G. Williams and J. Fraser.
Stamping, mechanism for varying letters or marks produced by—1595—J. Hay.
Stone-breaking, machinery for—1649—A. Thomas.
Telescopes, &c., stands for—1601—E. L. Berthon.
Thrashing machines, applying power to—1584—D. Crowe.
Tobacco, &c., packages for—1574—E. Francis.
Umbrellas, parasols, and sunshades—1625—T. Duffy.
Varnish—1618—J. A. Bouck and T. Hill.
Vessels, apparatus for steering—1665—R. K. Aitchison.
Voltaic apparatus for relief of hernia—1571—J. Tirat.
Washing and drying apparatus—1615—L. R. Bodmer.
Watches and time-pieces—1677—D. Tunks.
Water-closets, &c., apparatus for supplying water to—1616—T. Thomson and J. Murray.
Water-closets, portable—1622—J. H. Wilson.
Waterclosets and urinals—1627—M. L. J. Lavater and E. W. Niblett.
Yarns or threads, machinery for warping, &c.—1605—J. M. Johnson and J. Buckley.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Album—1676—W. E. Gedge.
Boot and shoes—1681—B. F. Sturtevant.

PATENTS SEALED.

134. W. H. Marks.
138. S. Wynn.
139. J. Thompson.
144. R. A. Brooman.
151. J. Hamer.
152. T. Lightfoot, G. P. Barnes, and J. Lightfoot.
163. E. T. Jarrold and G. J. Yates.
164. J. T. Hall.
166. C. Heptonstall & W. Lunn.
182. T. C. Clarkson.
195. R. A. Wright & E. Wright.
208. S. Moore.

From Commissioners of Patents Journal, July 19th.

PATENTS SEALED.

165. J. Burch and S. Fearnley.
171. H. C. Bagot.
174. J. Sewell.
190. D. Y. Stewart.
192. F. North.
196. J. Platt & W. Richardson.
199. J. E. Dix.
200. E. Lucius.
206. W. D. Grimshaw.
211. T. Bradford.
216. J. Stuttaford.
219. R. Martindale and J. Williams.
221. J. Combe and J. H. Smalpage.
231. S. Grafton.
234. W. T. Bury.
263. W. Clark.
299. J. Young.
333. J. Easton, jun., and T. Leigh.
413. R. Hornsby, J. Bonnall, and W. Astbury.
529. G. H. Ellis.
573. W. Clark.
723. J. Shepherd and J. Hoyle.
898. B. X. Richard and R. Radisson.
975. J. Stevens.
1294. W. Clark.
1403. W. E. Gedge.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1798. J. Mason.
1818. P. Shaw.
2076. G. F. Muntz.
1775. J. C. Coombe & J. Wright.
1777. B. Browne.
1781. W. Rigby.
1865. B. Brown and R. Hacking.
1779. J. H. Johnson.
1832. J. Platt.
1810. P. Williams.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1992. G. J. Wainwright and C. T. Bradbury.
1988. T. Roberts & J. Dale.
2003. W. E. Newton.